#14

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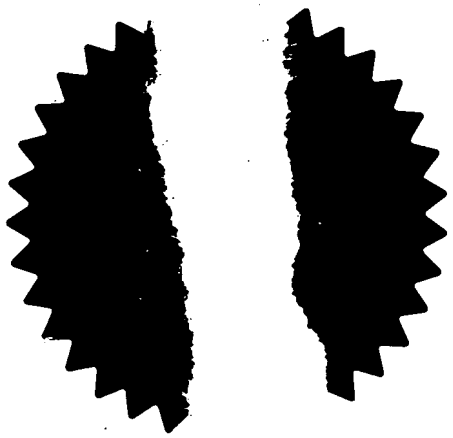

Signed G D Gant.

Dated 25 AUG 1998

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Dated 25 AUG 1998

For official use

22 OCT 1992

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26OCT92#00283453 1 77 UC 25.00

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Notes

Please type, or write in dark ink using CAPITAL letters. A prescribed fee is payable for a request for grant of a patent. For details, please contact the Patent Office (telephone 071–438 4700).

Rule 16 of the Patents Rules 1990 is the main rule governing the completion and filing of this form.

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Request for grant of a Patent

Form 1/77

Patents Act 1977

❶ Title of invention

1 Please give the title of the invention

LOW VOLTAGE FILTER

❷ Applicant's details

☒ **First or only applicant**

2a If you are applying as a corporate body please give:

Corporate name NORWEB PLC

Country *(and State of incorporation, if appropriate)* UNITED KINGDOM

2b If you are applying as an individual or one of a partnership please give in full:

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Forenames

2c **In all cases**, please give the following details:

Address TALBOT ROAD
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ADP number *(if known)* 01000213322 GB

2d, 2e and 2f: If there are further applicants please provide details on a separate sheet of paper.

❑ **Second applicant** *(if any)*

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3a Have you appointed an agent to deal with your application?

Yes [X] No [ ] ➡ ***go to 3b***

↓ ***please give details below***

Agent's name MEWBURN ELLIS

Agent's address 2 CURSITOR STREET
LONDON

Postcode EC4A 1BQ

Agent's ADP number 109001

3b: If you have appointed an agent, all correspondence concerning your application will be sent to the agent's United Kingdom address.

3b If you have not appointed an agent please give a name and address in the United Kingdom to which all correspondence will be sent:

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❼ *The answer must be 'No' if:*
- *any applicant is not an inventor*
- *there is an inventor who is not an applicant, **or***
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❼ Inventorship

7 Are you (the applicant or applicants) the sole inventor or the joint inventors?

Please mark correct box

Yes ☐ No ☒ ➡ ***A Statement of Inventorship on Patents Form 7/77 will need to be filed (see Rule 15).***

❽ *Please supply duplicates of claim(s), abstract, description and drawing(s).*

❽ Checklist

8a Please fill in the number of sheets for each of the following types of document contained in this application.

Continuation sheets for this Patents Form 1/77			
Claim(s)	2	Description	5
Abstract	1	Drawing(s)	1

Please mark correct box(es)

8b Which of the following documents also accompanies the application?

Priority documents *(please state how many)*	
Translation(s) of Priority documents *(please state how many)*	
Patents Form 7/77 – Statement of Inventorship and Right to Grant *(please state how many)*	
Patents Form 9/77 – Preliminary Examination/Search	1
Patents Form 10/77 – Request for Substantive Examination	

❾ *You or your appointed agent (see Rule 90 of the Patents Rules 1990) must sign this request.*

❾ Request

I/We request the grant of a patent on the basis of this application.

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LOW VOLTAGE FILTER

This invention relates to a low voltage filter especially for use with electricity transmission lines to ensure that unwanted high frequency signals do not contaminate low voltage network within a home or vice versa.

In order to simplify and increase efficiency of telecommunications services to domestic or industrial premises there have recently been investigations on using existing domestic electricity distribution networks to carry telecommunications services in the form of signals sharing the existing wiring. It will be apparent however that in order to make use of such an arrangement it will be necessary to ensure that the high frequency telecommunications signals do not contaminate the low voltage network present inside the premises i.e. for normal use, or that the signals from the low voltage network do not contaminate or corrupt the high frequency telecommunications signals being transmitted over the external distribution network.

An electrical filter is therefore required at the interface between the external distribution network and the internal premise's network to ensure that the two signals are separated. Such a filter should have minimal effect on the normal domestic supply and a draft standard for this purpose recommends a maximum voltage drop of one volt RMS across the filter at normal mains frequency.

A number of different transmission techniques are available for use with power line communication each using various modulation methods. It has been determined that the spread spectrum method offers inherent security and a good interference rejection. These properties are achieved using a large band width and hence requires the design of a specific filter.

It would be advantageous to provide a filter which could

separate a telecommunication signal from a mains voltage supply.

A first aspect of the invention accordingly provides a low voltage filter comprising a main inductor arranged between a mains input and a mains output and connected at each end thereof to a signal input/output line which is arranged in parallel to the main input and mains output, the two connections including a first capacitor and a second capacitor each of a predetermined capacitance.

In this arrangement the main inductor is operative to prevent communication signals from the signal input/output line from entering the domestic/industrial premises. This inductor is therefore preferably of a high inductance such as 50 μH.

The first capacitor which connects the mains input and the signal input/output line acts as a coupling capcitor to allow communication signals through from the signal input/output line whilst stopping all power frequency signals.

The second capacitor arranged between the mains output and the signal input/output line provides a further attenuation of communication signals and is connected via the signal input/output line to ground.

In the event of failure of either the first or second capacitor each such capacitor is preferably provided with a respective fuse arranged between the first or second capacitor and the signal's input/output line. Furthermore an additional safety precaution can be incorporated by provision of a second inductor arranged between the connections between the signal input/output line and the first and second capacitors. This inductor has no effect on communication frequency signals but will provide a path to ground if the first capacitor develops a fault thereby allowing the first fuse to blow without allowing the power frequency signal onto the signal

input/output line.

The inductance of the main inductor depends upon the material of which it is made and the cross-section of the wire wound around the core. The 50μH inductance previously specified is preferably a minimum and with use of better or higher quality materials a higher inductance, for example of the order of 200μH can be obtained. Alternatively, a number of inductors connected in series could be used.

The coupling capacitor has a capacitance preferably in the range 0.01 to o.50μF and the second capacitor linking the mains output with the signal input/output line and ground has a capacitance preferably in the range of 0.001 to 0.50μF. The second capacitor can be provided by the combined capacitance of two or more capacitors connected in parallel where this is required.

The second inductor arranged on the signal input/output line preferably has a minimum inductance of approximately 250μH. This inductor therefore has no effect on communication frequency signals on the signal input/output line.

In a preferred embodiment the filter is assembled in a diecast box so as to provide a good earth and prevent radiation of the communication signals.

A further aspect of the invention provides a low voltage filter for separation of a high frequency spread spectrum telecommunication signal from a low voltage distribution network.

A still further aspect of the invention provides a low voltage underground electricity distribution network including a plurality of filters operative to separate high frequency communication signals from a main electricity signal, each such filter being located at an individual consumer supply point.

The invention will be described further by way of example with reference to the accompanying drawing in which the single figure is a circuit diagram of a preferred embodiment of the invention.

Referring to the single figure a preferred embodiment of a filter according to the invention is indicated generally by the reference numeral 10 and is connected between a mains input 12 and a mains output 14. A signal input/output line 16 is also connected into the filter. The mains power line is a standard 50Hz mains power supply providing a domestic power source of 240 volts at a maximum current of 100 amps for normal usage.

The filter 10 is assembled into a diecast metal box which prevents radiation of the communication signals to externally located appliances and which provides a connection 18 to earth for the signal input/output line 16. The filter 10 includes a first or main inductor 20 formed of 16mm^2 wire wound on a 10 mm diameter, 200mm long ferrite rod with 30 turns of wire therearound. This provides an inductance of approximately 50 μH. This is a minimum for the signal characteristics utilised. The use of better materials or a plurality of series inductors would increase the inductance of the inductor up to, for example, approximately 200 μH.

Each end of the main inductor 20 is provided with a connection to the signal input/output line 16. A first connection 22 between the mains input 12 and signal input/output line 16 comprises a first or coupling capacitor 24 having a capacitance of between 0.01 and 0.50μF preferably 0.03μF. This coupling capacitor 24 is connected to a first fuse 26 which is arranged to blow in the event of failure or a fault developing in capacitor 24 having a capacitance of between 0.01 and 0.50μF, preferably 0.03μF. This coupling capacitor 24 is connected to a first fuse 26 which is arranged to blow in the event of failure or a fault developing in capacitor 24.

A second connection 28 includes a second capacitor 30 having a capacitance of between 0.001 and 0.50μF, preferably 0.1μF. This capacitor provides further attenuation of the communication signals by shorting to the earth or ground 18. A second fuse 32 is provided to blow if a fault develops in the second capacitor 30 thereby preventing further unit damage.

The signal input/output line 16 includes a second inductor 34 having an inductance of approximately 250μH minimum. This inductor is provided as a damage limiter in the event of failure of the coupling capacitor 24. In the event of such failure this inductor provides a path to the ground 18 for the 50Hz mains power frequency thereby blowing fuse 20. The inductor has no effect on the communication frequency signals present on the signal input/output line 16.

It will be seen from the foregoing that the invention provides a simple filter effectively separating signals having a frequency indicative of communication signals from those of standard mains power supply without significant loss of power or clarity in either signal. Thus the mains power supply can be used for both electricity supply and communication signals.

The use of a filter according to the invention at each consumer supply point in a low voltage underground electricity distribution network provides a conditioned network suitable for the transmission of high frequency communication signals together with the distribution of 50Hz, 240 Volts single and 415 Volts, 3 phase electricity supplies. The provision of such a conditioned network constitutes a further aspect of the invention.

The invention is not confined to the foregoing details and variations may be made thereto within the scope of the invention.

CLAIMS

1. A low voltage filter for separation of a telecommunication signal from a low voltage mains distribution network.

2. A low voltage filter as claimed in claim 1 comprising a main inductor arranged between a mains input and a mains output and connected at each end thereof to a signal input/output line which is arranged in parallel to the main input and mains output, the two connections including a first capacitor and a second capacitor each of a predetermined capacitance.

3. A filter as claimed in claim 2 in which the main conductor has an inductance of at least 50 μH.

4. A filter as claimed in claim 2 in which the second capacitor is connected via the signal input/output line to ground.

5. A filter as claimed in claim 2, 3 or 4 in which the first and the second capacitor are provided with a respective fuse arranged between the first or second capacitor and the signal's input/output line.

6. A filter as claimed in any of claims 2 to 5 in which a second inductor is arranged between the connections between the signal input/output line and the first and second capacitors.

7. A filter as claimed in any of claims 2 to 6 in which the first capacitor has a capacitance in the range 0.01 to 0.50 μF.

8. A filter as claimed in any of claims 2 to 7 in which the second capacitor has a capacitance in the range of 0.001 to 0.50μF.

9. A filter as claimed in any of claims 2 to 8 in which the second capacitor is provided by the combined capacitance of two or more capacitors connected in parallel.

10. A filter as claimed in any of claims 2 to 9 in which the second inductor has an inductance of approximately 2.5mH.

11. A filter as claimed in any of claims 2 to 10 in which the filter is assembled in a diecast box so as to provide a good earth and prevent radiation of the comunication signals.

12. A filter as claimed in any preceeding claim in which the telecommunication signal is a high frequency spread spectrum signal.

13. A low voltage filter substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

ABSTRACT

Figure (s) to accompany abstract

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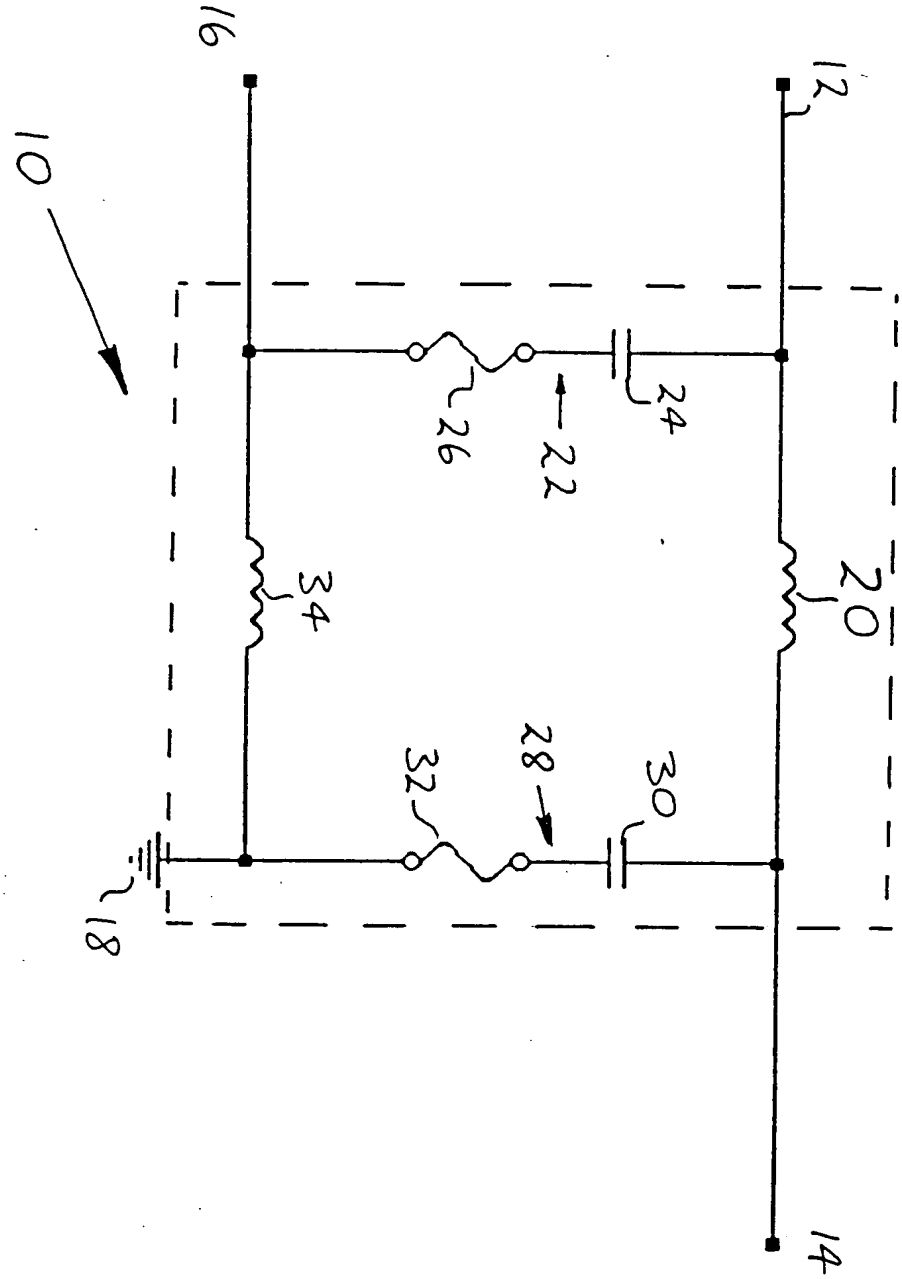
LOW VOLTAGE FILTER

A low voltage filter 10 for separating a high frequency telecommunication signal from a low voltage mains electricity distributor network comprises a first or main inductor 20 having a inductance of approximately 50μH, arranged between a mains input 12 and a mains output 14. A second inductor 34 is arranged in a signal input/output line 16 and first and second connections 22, 28 serve to interconnect the two inductors in parallel. The first connection 22 includes a first or coupling capacitor 24 and a first fuse 26 and the second connection 28 includes a second capacitor 30 and a second fuse 32, the second fuse is arranged to blow if, a fault develops in the second capacitor which is shorted to a ground 18.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